UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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June 21, 2010

Dr. Linda B. Shipp
Senior Manager
NEPA Compliance
Environmental Permitting and Compliance
Office of Environmental Research
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, TN 37902

Attn: Ms. Ruth Horton
Senior NEPA Specialist

Subject: EPA's NEPA Review Comments on TVA's FSEIS for the "Single Nuclear Unit at the Bellefonte Plant Site" (May 2010); Jackson County, Alabama; CEQ #20100179; ERP #TVA-A06090

Dear Dr. Shipp:

The U.S. Environmental Protection Agency (EPA) has reviewed the subject Tennessee Valley Authority (TVA) Final Supplemental Environmental Impact Statement (FSEIS) in accordance with our responsibilities under Section 102(2)(C) of the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act. TVA has identified an additional need for baseload capacity in the Tennessee Valley for the 2018-2020 timeframe. In response, TVA proposes to complete or construct and operate one nuclear generating unit at the Bellefonte Nuclear Plant (BLN) brownfield site with a capacity of at least 1,100 MW and up to 1,260 MW. The BLN site is a 1,600-acre peninsular site located on TVA's Guntersville Reservoir in Jackson County Alabama near the town of Hollywood and City of Scottsboro. EPA has previously provided comments on the Draft SEIS (DSEIS) for BLN in a letter dated December 11, 2009.

We note that TVA currently operates three nuclear sites in the Valley with two or more reactor units each: Browns Ferry Nuclear Plant (BFN) on the nearby Wheeler Reservoir in Alabama, and the Watts Bar Nuclear Plant (WBN) and Sequoyah Nuclear Plant (SQN) on the Chicamauga Reservoir in Tennessee.

For our review of the FSEIS, we have focused on TVA's specific responses to our comments on the DSEIS (Vol. 2: App. C). Our comments on selected TVA responses are provided in the enclosed *Detailed Comments*. In addition, we offer the following summary on the two reactor technologies being considered for BLN.

TVA has selected the Babcock and Wilcox (B&W) reactor technology (Alt. B) as its NEPA preferred alternative in the FSEIS (pg. 91) by virtue of electing to complete the Bellefonte Unit 1 (BLN 1), as opposed to starting new construction at BLN 3 or BLN 4 using the AP1000 reactor technology. Regarding the selection of the B&W design in the FSEIS, we note that TVA's post-DSEIS conference call with EPA as well as its FSEIS responses (App. C) and textual modifications (Sec. 2.2.3) have provided some assurances for the proposed B&W design. However, because of its notable passive safety features, EPA continues to prefer the Westinghouse AP1000 (AP1000) technology – predicated on approval by the U.S. Nuclear Regulatory Commission (NRC) of a final design.[1]

Although the FSEIS indicates that both the B&W and AP1000 designs can meet NRC safety requirements, such safety compliance (assuming NRC concurrence) requires continuous proper plant operation. In this regard, we believe that plant operation via the passive safety features of the AP1000 technology would require less reliance on mechanical equipment and trained operator surveillance and decision-making than the B&W design (e.g., these passive safety features would not require plant operator actions if an off-normal condition should arise requiring emergency shutdown). We note that this need for "far less equipment" for the AP1000 design was well documented in the FSEIS (pp. 88-89). EPA is also not aware of any new commercial nuclear plants that are being planned with the proposed B&W technology, even though we understand that some existing plants are continuing to use it. Moreover, the new construction of plant infrastructure required for the AP1000 design at BLN 3 or BLN 4 also seems inherently safer than the reuse of existing infrastructure constructed in the 1980s, despite proposed upgrades. In addition, the functionality of the constructed portions of BLN 1 has not been demonstrated since the partially-constructed B&W unit at BLN 1 was never operational.

Beyond these safety issues, EPA also believes that the AP1000 has some favorable environmental features since it has a smaller environmental footprint during its operating lifetime. Additionally, the state-of-the-art design of the AP1000 would likely lead to less environmental contamination and would result in a lower annual dose in a severe accident scenario (see Tables 3-43 & 3-44). It also has an overall reduced need for cooling water, resulting in lower withdrawal volumes for cooling water from the Tennessee River (Lake Guntersville) and lower discharge volumes of heated effluent returned to that ecosystem. As such, the AP1000 reactor is more efficient than the older B&W reactor design for these aspects.[2]

Regarding cost-effectiveness of completing construction versus new construction at BLN, EPA will appropriately defer such project cost considerations and decisions to TVA. However, the cost-effectiveness of completing construction of BLN 1 or BLN 2 may merit further consideration. We note (pg. 41) that actual completion of these sites is

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[1] This is not to say that EPA does not encourage the reuse of less critical (non-reactor-related) infrastructure at BLN (e.g. cooling towers) if demonstrated to be structurally competent for the project's proposed life cycle.

[2] In addition, the fewer components needed by the AP1000 design also implies that less energy would need to be dedicated to plant operation, also making the AP1000 technology more efficient.

considered less advanced today than in the 1980s when construction was suspended for both BLN 1 (55% v. 90%) and BLN 2 (35% v. 58%), since many outdated equipment components would need to be replaced in addition to completing construction. Accordingly, the level of completion of both of these sites is significantly reduced today by approximately 60%, such that the functional level of investment today is much less than in the 1980s. In addition, the life cycle of the B&W design may be less than for the AP1000 design (40+ yrs v. 60 yrs).[3] This difference is presumably to account for the over 20-year idle period of incomplete construction for BLN 1 and BLN 2 since the 1980s. The possible absence of a 20-year extension at the end of a unit's normal 40-year life span (a 50% increase in longevity) would appear to be a significant reduction in project cost-effectiveness for BLN 1 (and BLN 2).

In conclusion, while EPA commends TVA for pursuing energy technology options that reduce air emissions from power generation, we continue to recommend that TVA further consider a reactor technology that relies less on mechanical components and human operation, and more on passive safety design and redundant systems. In this regard, an approvable final design of the AP1000 (or competitive designs) continues to be EPA's environmental preference pursuant to NEPA. However, we give deference to the NRC regarding the identification of the appropriate reactor design at BLN based on NRC's licensing process and its associated NEPA documentation on that licensing process. EPA will participate in the review of NRC's NEPA documentation for BLN licensing.

EPA appreciates the opportunity to review the FSEIS. Should you have questions on our comments, please contact Chris Hoberg of my staff at 404/562-9619 or hoberg.chris@epa.gov.

Sincerely,

Heinz J. Mueller, Chief
NEPA Program Office
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Enclosure: *Detailed Comments*

[3] Table 2-2 indicates that the original design life is 40 years for the B&W design and 60 years for the AP1000 design. Page 28 states that the operating life of the B&W design at BLN 1 or BLN 2 "is expected to be at least 40 years.", which is an upgrade from the DSEIS (pg. 25) which simply states that it "is expected to be 40 years".

DETAILED COMMENTS

We offer the following comments on selected TVA responses to our comments on the DSEIS found in Appendix C of Volume 2 of the FSEIS. Additional comments are also provided subsequent to these comments on the TVA responses.

TVA Responses to Comments

* **EPA04 (Structural Integrity)** – Section 2.2.3 cited in this response addresses material/structural integrity, age and obsolescence, seismic Category I requirements and other issues based on TVA's Detailed Scoping, Estimating, and Planning (DSEP) project implemented to review such issues. EPA will continue to defer to the NRC to verify these TVA findings.

Regarding the structural integrity (specifically aircraft impact effects) of the existing BLN 1 unit proposed for completion under Alternative B preferred by TVA in the FSEIS, we note from page 38 that: "The BLN design will meet those licensing requirements and regulations [developed since the 9/11/01 event], including those regarding aircraft impact, as are all currently licensed nuclear plants nationwide" (the response to EPA68 provides a similar conclusion). Although "large commercial aircraft" were referenced earlier on page 38, it is unclear if the referenced "aircraft" in the above passage (and in EPA68) were also intended to mean "large commercial aircraft" or something smaller with less impact potential.

* **EPA05 (Reactor Comparison)** – We appreciate the comparison of the B&W versus the AP1000 technologies in Tables 2-2 and 3-3. We note the following:

In some respects, this reactor comparison is difficult since the rated capacities of these units are slightly different (3,600 MWt for the B&W design and 3,400 MWt for the AP1000 design). When compared environmentally to the B&W technology, it appears that the AP1000 technology would 1) require less dredging (although no site wetlands would be filled for the B&W and 12.2 acres of forested wetlands would be directly or indirectly impacted for the AP1000); 2) need less makeup water (24,000 v. 35,000 gpm) for cooling to be withdrawn from the Tennessee River and produce less heated (blowdown) effluent (8,000 v. 23,000 gpm) to be discharged back to the Tennessee River, 3) have a greater longevity (60 v. 40 yr original design life); 4) have a higher cost per kilowatt and a longer construction time; and 5) have the same spent fuel waste volumes once the AP1000 is normalized to the greater B&W capacity. However, the AP1000 design would require more plant water consumption (16,000 v. 12,000 gpm) and would have lower thermal efficiency (32.4% v. 35%).

While the Table 2-2 and 3-3 comparisons exhibit similarities between the two designs, the AP1000 design's reduced water volumes for withdrawals and discharges are noteworthy. Water use is discussed further below in "EPA18 (Water Use)".

* **<u>EPA09 (Green Power)</u>** – We appreciate the FSEIS summary of power options that do not require new generation capacity (power purchases, repowering electrical generating units, and energy conservation). We suggest that the ROD include an approximation of the percentage of TVA power (generated or purchased) that is renewable or "green" (wind, solar, hydropower, biomass, co-generation, etc.) and saved through demand side power (conservation) incentives, as well as goals in this regard.

EPA is pleased that TVA is increasing its generation capacity through modernizing its hydrogenation (turbine efficiency) more so than constructing new hydrodams, which have their own environmental impacts. We also agree that conservation programs are "...highly dependent on the end users' recognition of the cost effectiveness of conservation". However, we recommend that such programs continue to be offered in such a way that the benefits of conservation become obvious to the end users, such as installing smart meters that show kilowatt-hour and power bill savings through implementing conservation methods and upgrades such as Energy Star appliances.

* **<u>EPA11 (Site Selection)</u>** – Regarding considered alternate sites to BLN, EPA's DSEIS comment requested that "...these site options might be revisited for verification in the FSEIS." TVA's silent response of "comment noted" is not useful in verifying if other available sites were further considered instead of the BLN site. The EPA11 response could have been improved by stating that given sites were or were not reconsidered, that no changes were felt necessary for the FSEIS, or that the BLN site was still preferred. We recognize that, although the BLN site has never had operating power plant units, it has the advantage of being a former construction site that has already undergone a site selection process many years ago.

* **<u>EPA14 (Safety)</u>** – This response states that both the B&W and the AP1000 designs "...would meet all NRC safety requirements" and that the "...AP1000 design is different, but not safer." We agree that it is possible for both the B&W and AP1000 designs to meet NRC safety requirements if operated properly, although we will continue to defer to NRC in that regard. However, we believe that the passive safety features of the AP1000 technology would provide much less reliance on mechanical means and operator surveillance and training than the B&W design. Therefore, the AP1000 design would inherently seem safer than the B&W design requiring more active (human) operation and decision-making. Ultimately, however, we believe that selection of the appropriate reactor for BLN will need to be determined by the NRC in its licensing process and the associated NRC NEPA documentation, as well as through NRC's approval or disapproval of the AP1000 final design, or competitive designs.

As part of this NRC safety decision, we suggest that that the relative potential of these two technologies for tritium (and other radionuclide) leaks and their migration into the groundwater be addressed, since this leak issue is becoming a more frequent concern for existing nuclear plants. EPA recommends that the TVA ROD also address this issue.

* **<u>EPA15 (Site Waters of the US)</u>** – For comparison against the 12.2 acres of forested wetland impacts predicted for the AP1000 sites (Alt. C), the ROD should also discuss

how many acres of wetlands may have already been filled (if any) during the original site clearing and preparation for BLN 1 and BLN 2 in the 1980s.

* **EPA16 (ROW Waters of the US)** – The number of acres of wetlands that are predicted to be filled along the rights-of-way (ROW) in order to re-energize, refurbish and upgrade project transmission lines should be estimated in the ROD. Would such wetland impacts be permanent (e.g., access roads) or temporary, and regulated under a nationwide or individual Section 404 (Clean Water Act) permit? We recommend that transmission lines span wetland areas along the ROW to the extent feasible and that buffer areas be left around wetlands (even if larger trees are cut within and near the ROW). Streams may also not need to be culverted if access can be achieved on either side of the waterway by maintenance vehicles.

* **EPA18 (Water Use)** – As suggested previously in "EPA05", Tables 2-2 and 3-3 show that, compared to the B&W design, the AP1000 design results in less water volumes being withdrawn for cooling (makeup water) as well as discharged as heated effluent (blowndown). However, the circulating condenser water flow rate (500,000 v. 420,000 gpm) and consumptive evaporation (16,000 v. 12,000 gpm) are greater for the AP1000 design.

Table 2-2 indicates that the B&W design is more thermally efficient than the AP1000 design (35% v. 32.4%). We assume therefore that the B&W technology re-uses heat better than the AP1000 technology. However, it is unclear from these tables and text (pg. 86) whether this difference in thermal efficiency translates into a hotter or cooler heated effluent. The ROD should discuss if the greater discharge volume of the more thermally efficient B&W design is hotter or cooler on average than the lower discharge volume of the less thermally efficient AP1000 design.

From an environmental perspective, the temperature and volume of the heated effluent discharge is significant for effects on water quality and fisheries in the Tennessee River receiving waters. Maintaining a thermal balance in the receiving waters is also important for plant operational compliance since heated effluent temperatures and volumes could result in undesirable power curtailments (deratings) in hot summers with low river flows in order to remain in compliance with the State of Alabama's National Pollutant Discharge Elimination System (NPDES) permit. We note that the TVA BFN plant near Decatur, Alabama, which also uses the Tennessee River at Wheeler Reservoir for water withdrawal/discharge, has experienced periods of power deratings, suggesting that river flows and ambient temperatures are not always adequate for plant operation at that location of the Tennessee River. It is unclear if this could also eventuate for BLN at Lake Guntersville.

With regard to plant water consumption, the AP1000 design would proportionately consume more water (evaporative consumption) than the B&W design even though withdrawal and discharge volumes would be less. Although this is apparently due to its lower thermal efficiency discussed above, the ROD should discuss this further. In any event, it can be assumed that the evaporative losses from the cooling towers would eventually re-enter the hydrologic cycle as rain somewhere downwind for both designs, although perhaps in a different watershed.

EPA agrees that the Tennessee River at Lake Guntersville should be a plentiful water supply source for BLN withdrawals to cool the proposed single nuclear plant unit. However, if up to four units were to be constructed at BLN at some time (as well additional river withdrawals by other future regional development), there would be a water-use cumulative effect. In addition, reduced water intake volumes of the AP1000 design would minimize the entrainment mortalities of fish eggs and larvae (ichthyoplankton). Therefore, plant (unit) water efficiency is important.

* **EPA20-25 (EJ)** – EPA appreciates the additional environmental justice (EJ) information presented in the FSEIS (pp. 166-171). We recognize that EJ evaluations using U.S. Census data may be somewhat inaccurate at the very end of a census decade. Nevertheless, 2000 U.S. Census data show that the block group (BG) encompassing the proposed BLN site consists of a minority percentage population (15.0%) that is notably less than the state (29.7%) average, but notably greater than Jackson County as a whole (8.8%). This trend was expected to be similar for more recent 2008 data, even though increases in minorities such as Hispanics were acknowledged. In addition, Jackson County has an unemployment rate that is more that double that of the State of Alabama (11.7% vs. 5.7%, respectively).

The EJ analysis appears to focus on subsistence and other stressed communities that could be disproportionately impacted by the project. We note that outreach to bait and tackle shops was provided to determine subsistence. However, specific outreach strategies or findings were not disclosed, other than a conclusion that no disproportionate resource dependencies were found (pg. 169). While determining subsistence is an important first step for assessing whether significant environmental conditions exist that may affect EJ communities, a better approach for determining EJ impacts would have been to provide more direct public outreach to the communities themselves (which may or may not have attended the SEIS Public Hearing) through their community and church leaders, and to document their comments and concerns relative to the proposed project and to determine any EJ community concentrations near the BLN site (the FSEIS notes that minority and low-income groups are scattered (pg. 170), but it is unclear how this was determined in the COLA ER). Given the relatively small size of the project area, community surveys could have been conducted to assess potential EJ issues.

Even if a reactor design that is less reliant on human surveillance and mechanical components is implemented at BLN, living near a nuclear power plant carries an associated risk for all affected demographics. However, these impacts may have greater effects on minorities and low-income populations living there by virtue of their limitations, which typically relate to lower health levels, educational and financial conditions, and opportunities to relocate. The FSEIS notes that available housing in the area is limited and that the potential EJ impacts exists for increased housing costs due to the increased demand from plant construction workers (pg. 171). TVA indicates that existing housing availability will be reviewed prior to construction to assess whether mitigation is needed. This type of information should be disclosed for public consideration and federal decision-making at the EIS, and no later than ROD, phase.

Current FSEIS and referenced previous COLA ER data suggest that minorities were on average elevated in the project area compared to the rest of the county, but that the county as a whole was lower than the state average. As such, EJ need not be a substantive impact, but the BLN site appears to be located in a higher minority concentration of Jackson County. EPA recommends that the ROD include U.S. Census data for neighboring BGs to determine if they are similar to or lower than the BLN BG. We also recommend that additional public outreach be provided to determine current comments and possible complaints, with emphasis on minorities and on low-income groups of all demographics. If the project proceeds and is implemented, outreach should also continue with periodic meetings, newsletters, a website and a hot line to provide updated information. We are pleased to note that TVA does plan outreach to all affected demographics (see EPA25).

As a consequence of living near a nuclear plant, affected populations (particularly EJ populations) might also be offered offsets such as construction/operation job opportunities (if qualified) and educational opportunities (in order to be more competitive for such jobs). Alternatively, voiced community needs (within reason) could be discussed as offsets for such EJ populations. The ROD should review such options.

* **EPA27-28 (Cumulative Effects)** – We appreciate that cumulative impacts information on foreseeable non-federal projects in the region was added in the FSEIS (pg. 183). However, typical construction and operational impacts of such projects (wetlands, air quality and land clearing) are not necessarily the primary impacts of cumulative concern for the proposed project. That is, the overarching concerns for the BLN proposal are nuclear risk (failure/human exposure and radionuclide leaks, such as tritium, migrating into the ground water); water quality (thermal discharge and fishery-effects); and water quantity (surface water withdrawal volumes).

Therefore, cumulative effects relevant to the BLN site would principally be any impact contributions at BLN in combination with existing impacts from other nuclear plants (particularly radiological effects) or other development within the project area. Therefore, the ROD should substantiate if there are any other upstream or downstream nuclear plants (TVA or others) proximate enough to cumulatively affect such sites along the Tennessee River. For example, would the thermal effluent at BLN exacerbate the level of thermal enrichment at another nuclear or fossil fuel power plant along the Tennessee River (such as BFN on Wheeler Reservoir)? While this seems unlikely, it is more likely that BLN discharges could contribute to and exacerbate other point source discharges along the River, and that potential tritium leaks could contribute to any existing radionuclide or other groundwater contamination. Also, would the water withdrawal needs of the proposed unit cumulatively affect other such withdrawals along the river in terms of total volumes removed per day (e.g., drinking water, commercial and industrial intake volumes)? The ROD should discuss this further with emphasis on the identified BLN project area of influence.

EPA33-34 (Meteorological Data) – The additional information in Appendices I and J provides the information requested. The additional FSEIS Table 3-13 in Section 3.16.1.1 (pg. 193) is a valuable addition but some of the percent values given for the three stability classifications and three data periods do not agree with the percent values for these stability classes and data periods provided in Appendix J.

EPA39 (Receptor Types & Location) – The added FSEIS discussion in Section 3.16.1.2 responding to our comment is confusing. It appears that the added text indicates the Maximum Receptor Type Values column in Tables 3-14, -15 and -16 are either the location of the receptor with the maximum modeled x/Q and D/Q values or the location of the receptor corresponding to the location of the actual Maximum Exposed Individual (i.e., location of the nearest actual garden, cow, goat, etc). The added discussion does not clearly communicate this information.

EPA45 (PSD Class I Areas) – The response provided in Appendix C to our comment concerning the need to include Class I area impact assessment appropriately resolves our concern. However, this information has not been included in the FSEIS text. The text still incorrectly indicates PSD Class I areas are only considered if within 100 km of the project location. Therefore, the FSEIS (text) does not address PSD Class I area impacts because the two nearest areas are beyond 100 km.

Other Comments

Based on the rated and/or design differences of the proposed B&W (3,600 MWt) and AP1000 (3,400 MWt) units for BLN (Table 2-2), we offer the following additional comments:

- Table 2-6 indicates that for the same number of refueling cycles over the 40-year projected operating lifetime of the reactors, the number of spent fuel assemblies and the total amount of spent fuel generated is less for the AP1000 design when compared to the B&W design.

- The format of Tables 3-33 and 3-34 are not consistent. The tables should be consistent to allow a direct comparison between the radioactive wastes generated by the B&W and AP1000 designs.

- The spent fuel pool for the AP1000 reactor has a year-and-a-half more storage capacity than the B&W reactor.

- Table 3-36 shows that if an independent spent fuel storage installation (ISFSI) is needed due to the lack of a permanent national high level radioactive waste repository, the AP1000 design would generate 20 less spent fuel casks during 40 years of operation, which would result in a smaller environmental footprint.

- Table 3-37 indicates that the cumulative radiation exposure from the ISFSI to plant workers is less from the AP1000 than the B&W reactor.

- A comparison between Tables 3-43 and 3-44 shows that for severe accident individual annual risks, the common scenarios evaluated resulted in smaller dose risk and cancer fatality numbers for the AP1000 because of its more advanced design, as opposed to the B&W design.

- Editorially, the typographical error noted on lines 5 and 6 of the first paragraph on page 235 of chapter 3 should be corrected to show "Atlantic Compact" instead of "Atlanta Compact".